



## **pci gigabit ethernet performance paper**

**a6825a / a6847a**



**using hp server rp7410**



**September 2002**

U.S.A.

© 2002 Hewlett-Packard Company

**the design  
makes  
the difference**

## Table of Contents

<b>introduction .....</b>	<b>1</b>
<b>summary .....</b>	<b>1</b>
<b>test details .....</b>	<b>2</b>
<b>products used in testing .....</b>	<b>2</b>
<b>test configuration .....</b>	<b>3</b>
<b>gigabit ethernet performance data .....</b>	<b>4</b>
<b>throughput .....</b>	<b>5</b>
<b>average throughput per card .....</b>	<b>6</b>
<b>cpu utilization .....</b>	<b>7</b>
<b>performance highlights .....</b>	<b>8</b>
<b>additional information .....</b>	<b>8</b>
<b>taking the next step .....</b>	<b>8</b>

## introduction

HP leads the industry in PCI Gigabit Ethernet (GbE) performance, reliability, and supportability. With the introduction of the second generation PCI Gigabit Ethernet Adapters, HP extends its leadership position.

HP's new 1000Base-SX NIC solution (using multi-mode fiber cable and supporting distances of up to 550m) and 1000Base-T NIC solution (using CAT5 UTP cable and supporting distances of up to 100m) both offer the same level of performance with the only difference being cost and distance.

This paper provides basic I/O performance information for the A6825A 1000Base-T and A6847A 1000Base-SX Gigabit Ethernet LAN Adapters when installed in the hp server rp7410. This paper is not an exhaustive source for HP LAN adapter performance information. It provides a guideline for expected performance from the A6825A and A6847A Gigabit Ethernet LAN Adapters.

Both the A6825A and A6847A Gigabit Ethernet adapters are designed to maximize server CPU efficiency with advanced features such as protocol offloading through on-board TCP, UDP, and IP checksum calculations and optional jumbo frame support (9000 byte maximum transfer unit, MTU) for improved efficiency and performance with bulk data transfer.

The hp server rp7410 is a highly dependable, adaptable, and efficient midrange server for the data center. The rp7410 brings added efficiency and economy of operation to the midrange server market.

This paper addresses the performance capabilities of the A6825A 1000Base-T and A6847A 1000Base-SX Adapters when used in the hp server rp7410.

## summary






The hp server rp7410 is an excellent midrange server, and with the HP Gigabit Ethernet NICs provides a winning combination of capabilities.

The HP Gigabit Ethernet adapters together with the 8-way rp7410 provide outstanding networking performance, with linear scaling of Transmit data and Receive data for up to 4 cards. Additional cards may also be added to provide greater connectivity.

## test details

### products used in testing

The following products were used for the performance measurement tests:

products used with netperf for the performance measurement test		
<b>Server Tested</b>		rp7410 <ul style="list-style-type: none"> <li>Eight, 750 MHz CPUs</li> <li>16 GB RAM</li> <li>Operating System - HPUX 11i version B.11.11.0203</li> </ul>
		A6847A PCI 1000Base-SX Adapter <ul style="list-style-type: none"> <li>Gigabit Ethernet 1000 Base-SX LAN</li> <li>PCI-4X (64-bit, 66 MHz)</li> <li>LAN Driver version – Gigether-01 B.11.11.04</li> </ul>
<b>Clients generating the test load</b>		Sixteen j6000 workstations <ul style="list-style-type: none"> <li>Two, 552 MHz CPUs each</li> <li>Operating System - HPUX 11i version B.11.11.0112.6</li> </ul>
		Odd numbered j6000's: <ul style="list-style-type: none"> <li>One A6847A PCI 1000Base-SX Adapter</li> <li>LAN Driver version – GigEther-01 B.11.11.04</li> </ul> Even numbered j6000's: <ul style="list-style-type: none"> <li>One A4926A PCI 1000Base-SX Adapter</li> <li>LAN Driver version – GigEther-00 B.11.11.14</li> </ul>
<b>Benchmark software</b>		<b>Netperf</b> is the benchmark software suite that generated LAN traffic for these performance tests. For more information about netperf or to get a free copy of netperf, go to <a href="http://www.netperf.org">http://www.netperf.org</a>

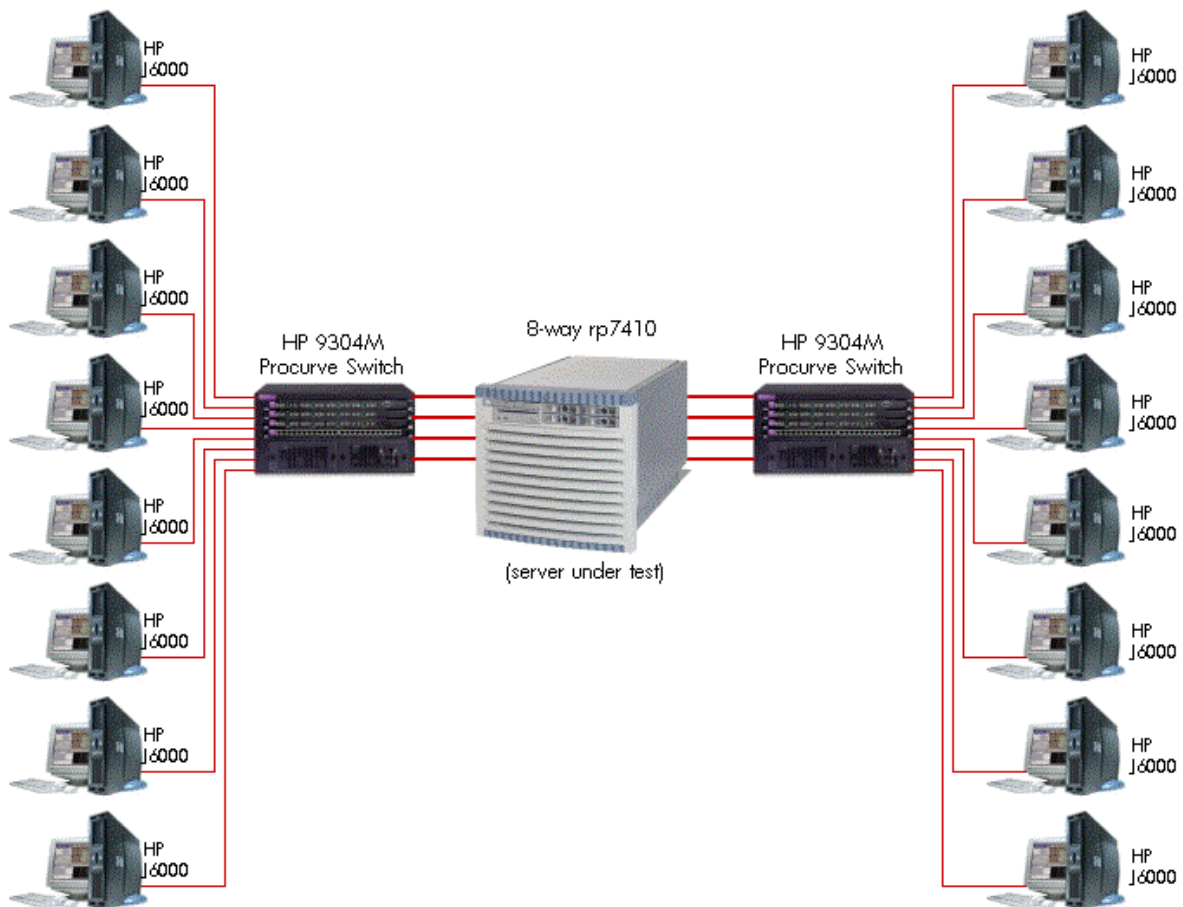
## test configuration

The test configuration consists of an 8-way (750 MHz) rp7410 with 16 Gigabytes of system memory and eight A6847A Gigabit Ethernet cards. The cards were connected to one of two HP 9304M Procurve Routing Switches. The tests were repeated with different configurations of cards, and the results in all cases were very similar.

The test load was generated by 16, 2-way j6000's, each containing a single 1000Base-SX Gigabit Ethernet Adapter. Each NIC in the rp7410 was connected to two j6000's through a switch.

### NOTES:

- The networking performance of the HP PCI 1000Base-SX NICs and PCI 1000Base-T NICs is identical.
- The observed performance results are consistent across all I/O slots of the system.



## **gigabit ethernet performance data**

The performance of the Gigabit Ethernet adapters is measured with the following traffic types:

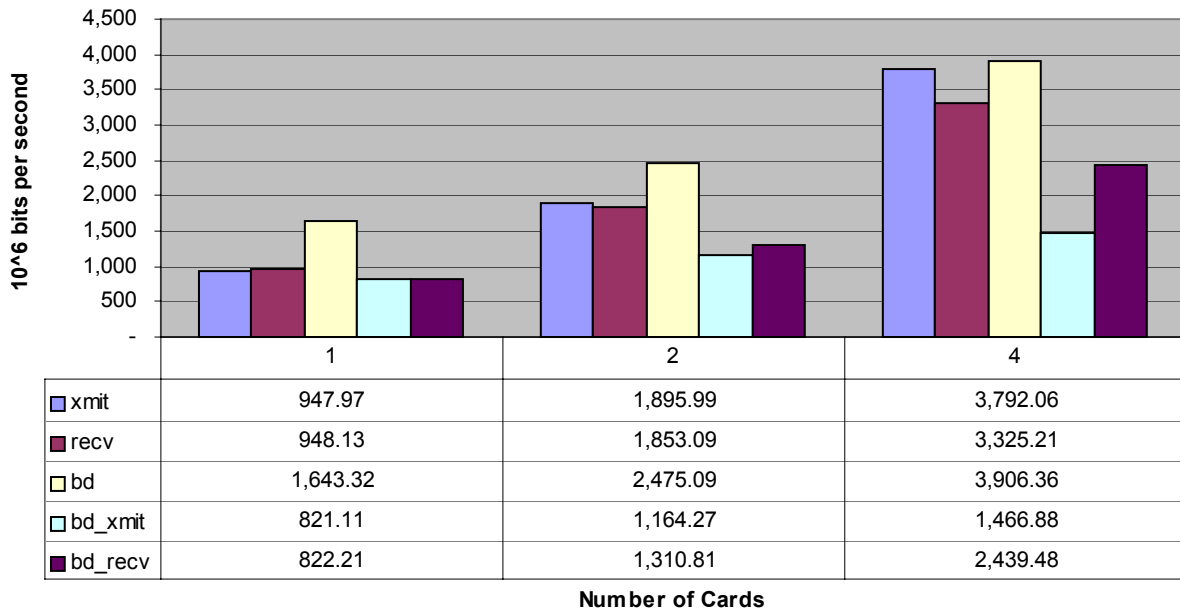
- Transmit (TX) using netperf with socket size of 128K bytes and message size of 32K bytes
- Receive (RX) using netperf with socket size of 128K bytes and message size of 32K bytes
- Bi-directional (BD) running the TX and RX tests concurrently

### NOTE:

- The A6749-60001 core LAN/SCSI card in the rp7410 had only minimal site LAN traffic during performance testing.

## throughput

Gigabit Ethernet Throughput on 8-Way rp7410



The above chart shows the throughput performance of 1, 2, and 4 Gigabit Ethernet cards in an 8-way rp7410. Throughput numbers are shown in  $10^6$  bits per second, or Mbps.

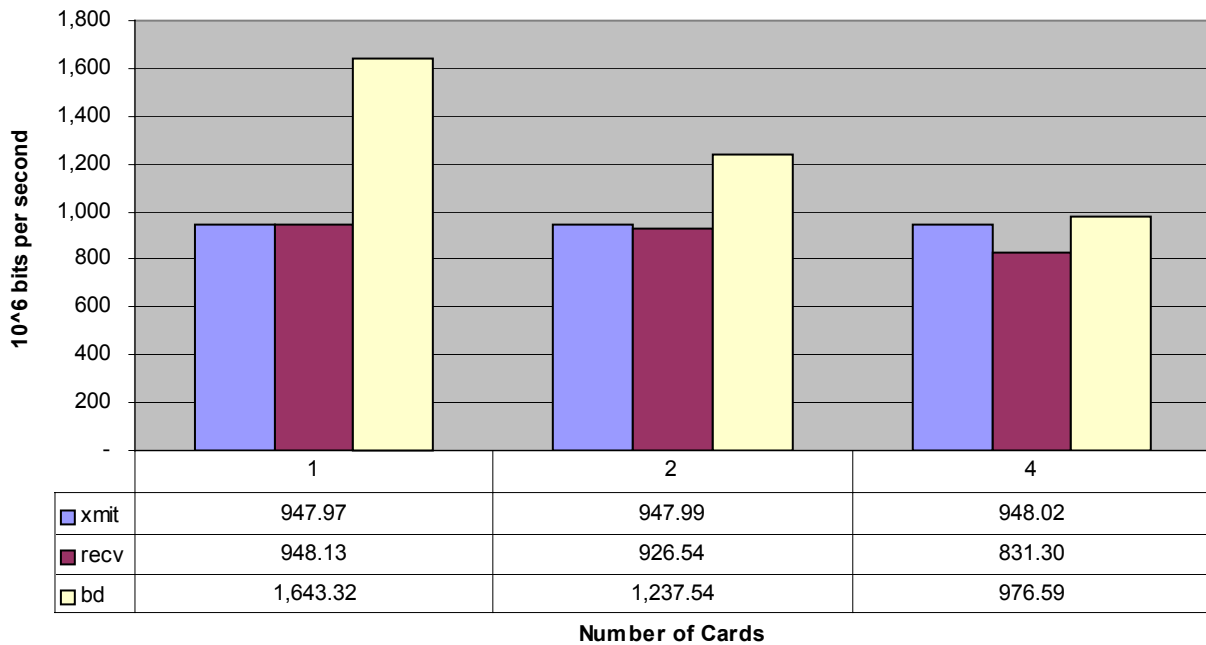
As the chart shows, one NIC transmits well over 947 Mbps of user data across the Gigabit Ethernet link. Two NICs scale at 2x the performance of a single NIC to transmit 1895.99 Mbps. Four NICs scale at 4x the performance of a single NIC, transmitting a total of more than 3792 Mbps of user data.

On the receive side, one NIC receives up to 948.13 Mbps of user data. Two NICs scale to approximately 2x the performance of a single NIC, receiving 1853.09 Mbps. Four NICs scale at approximately 4x the performance of a single NIC, receiving up to 3325.21 Mbps.

The chart demonstrates outstanding performance, with linear scaling on transmit and receive for up to four cards. Thus, the rp7410 supports up to four Gigabit Ethernet adapters at full unidirectional link rate. Additional NICs can be added to provide greater connectivity, up to a total of 15 Gigabit Ethernet cards for the system. For example, two more NICs add an additional 500 Mbps of bi-directional throughput, yielding an aggregate bandwidth across the six NICs of 4413.41 Mbps of bi-directional data.

## average throughput per card

Gigabit Ethernet Per Card Average Throughput on 8-Way rp7410



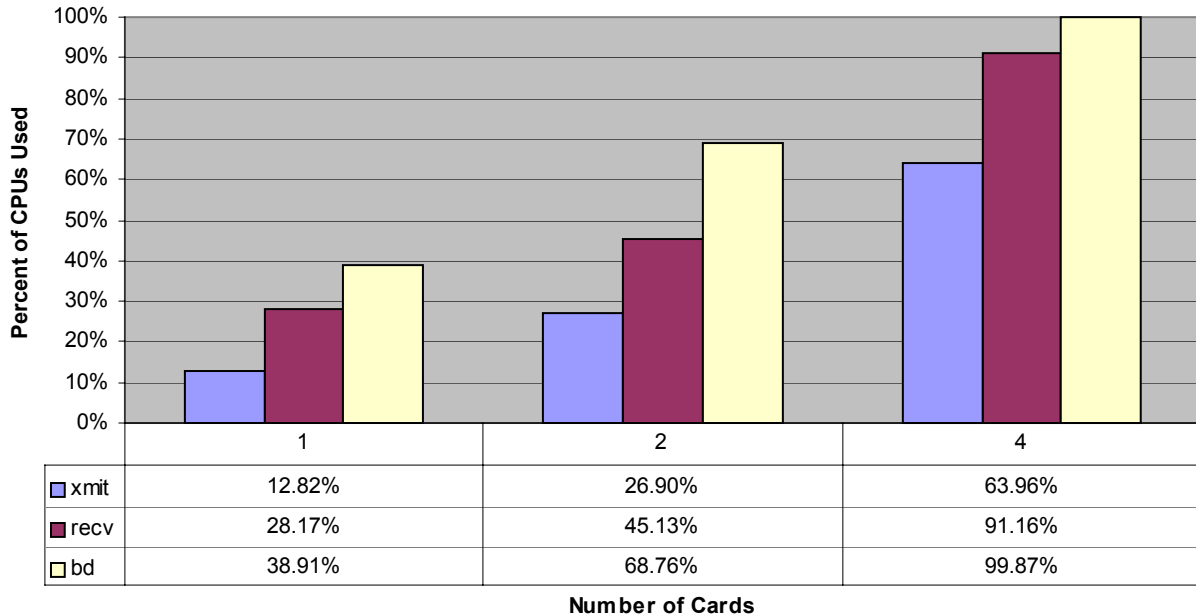
As demonstrated in the chart above, the average throughput per card for transmit data is the same for two cards and four cards as it is for a single card. The average throughput per card for receive data on two and four cards compared to one card is exceptional as well.

The decline in average bi-directional throughput as the number of cards increases results from the rp7410 nearing the limit of its CPU capacity. This is discussed more fully on the following page.



## cpu utilization

CPU Utilization on 8-Way rp7410 for Gigabit Ethernet



This chart shows the total amount of CPU utilization for 1, 2, and 4 Gigabit Ethernet cards in an 8-way rp7410. With two NICs running at link rate with receive only traffic, the rp7410 still had approximately 55% of its CPU cycles available for other applications. When supporting two NICs with transmit only traffic running at link rate, the rp7410 had over 73% of its CPU capacity available for other applications. A total of four Gigabit Ethernet NICs can be operated at full link rate carrying unidirectional data without driving the CPU utilization to the limits of its capacity.

With two NICs running at link rate and carrying bi-directional traffic, the rp7410 had over 31% of its CPU cycles available for other applications. As illustrated in the above chart, when four NICs are carrying bi-directional traffic the CPU utilization is very close to 100%. This indicates that the rp7410 is reaching the limit of its CPU capacity. Bi-directional traffic consumes more of the system's resources than either transmit-only or receive-only traffic. Therefore, as the total volume of bi-directional traffic increases, the demand on system resources increases faster than it does for unidirectional traffic.

This increasing load on the CPUs causes the limiting of bi-directional throughput as the number of cards increases, as shown on the previous chart.

## performance highlights

- The rp7410 provides incredible network performance, supporting up to four Gigabit Ethernet NICs running at link rate simultaneously with unidirectional traffic.
- The rp7410 scales linearly through four NICs with unidirectional traffic for industry-leading Gigabit Ethernet performance.
- Additional Gigabit Ethernet NICs can be added for greater connectivity, up to a total of 15 NICs for the system.

## additional information

This paper is the latest in a series of white papers detailing the performance of HP's link and server products. For a complete list of white papers on HP's Gigabit Ethernet solutions, go to <http://docs.hp.com/netcomm/index.html>, scroll down to "1000Base-T and 1000Base-SX (Gigabit Ethernet)" and look under "White Papers."

For more information about HP or other HP products go to <http://www.hp.com/>

For more information about HP's full line of rack-optimized Unix servers, go to <http://www.hp.com/products1/servers/rackoptimized/index.html>

For more information about HP's super-scalable superdome server, go to <http://www.hp.com/products1/servers/scalableservers/index.html>

For more information about the hp server rp7410 go to [http://www.hp.com/products1/servers/architecture/pa\\_risc/](http://www.hp.com/products1/servers/architecture/pa_risc/) and click on 'rp7410' to see the product brief.

The product brief provides an overview of the rp7410 and access to additional information such as the rp7410 technical white paper. In the product information area of the product brief click on information library to find a list of available documents.

For more information about the A6825A and A6847A Gigabit Ethernet Adapters, view the Gigabit Ethernet family product brief at [http://www.hp.com/products1/unixserverconnectivity/adapters/ethernet/infolibrary/gigapbww\\_801.pdf](http://www.hp.com/products1/unixserverconnectivity/adapters/ethernet/infolibrary/gigapbww_801.pdf)

## taking the next step

With performance that scales superbly through four Gigabit Ethernet NICs, the HP server rp7410 with the A6825A / A6847A Gigabit Ethernet Adapters is a winning combination.

Contact your local hp Sales Representative for a current list of tested products and a detailed analysis of specific requirements and needs.

### **Legal Notices**

The information in this document is subject to change without notice.

Hewlett-Packard makes no warranty of any kind with regard to this white paper, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Hewlett-Packard shall not be held liable for errors contained herein or direct, indirect, special, incidental or consequential damages in connection with the furnishing, performance, or use of this material.

©Copyright 2002 Hewlett-Packard Company, all rights reserved.

HP-UX® is a registered trademark of the Hewlett-Packard Corporation. All other trademarks and registered trademarks are the property of the respective corporations.

Reproduction, adaptation, or translation of this document without prior written permission is prohibited, except as allowed under the copyright laws.